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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/532,649	10/12/2005	Bin Liu	3248-6977US (R/5/1145 PK/r	4382
24247 TRASKBRITT, P.C. P.O. BOX 2550 SALT LAKE CITY, UT 84110	7590 08/27/2009		EXAMINER HEINCE, LIAM J	
			ART UNIT 1796	PAPER NUMBER
			NOTIFICATION DATE 08/27/2009	DELIVERY MODE ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

USPTOMail@traskbritt.com

### Office Action Summary

**Application No.**

10/532,649

**Applicant(s)**

LIU, BIN

**Examiner**

Liam J. Heincer

**Art Unit**

1796

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 24 June 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-21, 32-42, 48-53, 60-63, 65 and 66 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-21, 32-42, 48-53, 60-63, 65 and 66 is/are rejected.
- 7) ☒ Claim(s) 8 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Claim Objections***

Claim 8 objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 8 requires A and B to be hydrogen or NR'R". However, claim 1, from which claim 8 depends, requires at least one of A and B to NR'R"R". As the scope of claim 8 is outside the scope of claim 1, the claim does not further limit the subject matter of the claim from which it depends.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 32-42, 60-63, 65, and 66 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Considering Claim 32: Claim 32 is directed towards a process comprising quaternizing polymers that contain cationic ammonium groups. The original specification provides support for quaternizing polymers containing non-cationic amines (see e.g. original claim 32), but does not provide support for quaternizing a polymer that already contains quaternized ammonium ions.

Considering Claim 60: Claim 60 is directed towards a process comprising quaternizing monomers that contain cationic ammonium groups. The original specification provides support for quaternizing monomers containing non-cationic amines (see e.g. original claim 60), but does not provide support for quaternizing a monomer that already contains quaternized ammonium ions.

Considering Claim 66: Claim 66 does not require one of the phenylene units (unit a) to have both a C-R<sub>5</sub>-E and a D-R<sub>6</sub>-F group. There is not support in the original specification for a structure with phenylene units absent these groups.

Claims 1-21, 32-42, 48-53, 60-63, 65, and 66 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Considering Claim 1: Claim 1 recites that A and B are selected from H, SiR'R'' or NR'R''. Claim 1 additionally recites that at least one of A and B is NR'R''R'''. As NR'R''R''' is not in the original recited list of possible structures for A and B, this limitation renders it unclear whether the list of possible structures for A and B is closed or open. For the purpose of further examination the claims will be interpreted as requiring A, B, E, and F to be chosen from the group consisting of H, SiR'R'', NR'R'' or NR'R''R''', to meet the definition provided in the original specification for the cationic polymer (5:7-29). The proviso that at least one of A and B is NR'R''R''' is also be considered in the instant interpretation.

Claim 1 contains the structure SiR'R'' in the definition of A, B, E, and F. (It is noted that the same structure in the context of C and D later in the claim appears to be correct). This structure provides a trivalent silicon atom when considered in context of the structure. Silicon is naturally tetravalent. It is not clear whether the claim requires a double bond between the R groups and silicon, or whether the proper structure is SiR'R''R'''. For the purpose of further examination, the claim is being interpreted as having the structure SiR'R''R'''.

Considering Claim 32: Claim 32 recites that A and B are selected from H, SiR'R'' or NR'R''. Claim 32 additionally recites that at least one of A and B is NR'R''R'''. As

NR'R''R''' is not in the original recited list of possible structures for A and B, this limitation renders it unclear whether the list of possible structures for A and B is closed or open. For the purpose of further examination the claims will be interpreted as requiring A, B, E, and F to be chosen from the group consisting of H, SiR'R'', NR'R'' or NR'R''R''', to meet the definition provided in the original specification for the cationic polymer (5:7-29). The proviso that at least one of A and B is NR'R''R''' is also be considered in the instant interpretation.

Claims 32-36 and 38 include a required step of quaternizing at least one of A and B. However, as the polymer formula in claim 32 explicitly teaches that x can be zero, there are not required to be any units comprising A or B. As such, it is unclear whether A and B are required in the claim, and whether the quaternizing step is optional as well. In order to give the claim the broadest reasonable interpretation, the claim is being interpreted as not requiring A and B, and the quaternizing step is considered to be optional.

Considering Claim 60: Claim 60 recites that A and B are selected from H, SiR'R'' or NR'R''. Claim 60 additionally recites that at least one of A and B is NR'R''R'''. As NR'R''R''' is not in the original recited list of possible structures for A and B, this limitation renders it unclear whether the list of possible structures for A and B is closed or open. For the purpose of further examination the claims will be interpreted as requiring A, B, E, and F to be chosen from the group consisting of H, SiR'R'', NR'R'' or NR'R''R''', to meet the definition provided in the original specification for the cationic polymer (5:7-29). The proviso that at least one of A and B is NR'R''R''' is also be considered in the instant interpretation.

### ***Claim Rejections - 35 USC § 102***

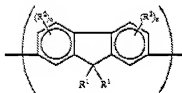
The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-6, 11-16, 18, 21, and 49-52 are rejected under 35 U.S.C. 102(n) as being anticipated by Woo et al. (US 6,169,163).

Considering Claims 1, 13-16, 18, 21, 49-52: Woo et al. teaches a polymer of the



formula

(3:1-10) where  $R^1$  is preferably a

poly(alkyleneoxy) group/linear aliphatic group containing hydrocarbons with a terminal group of

$-(CH_2)_yN^+(R^1)_3$  (4:27-33). Woo et al. teaches the polymer as having at least 10 repeat units (2:65-67). The terminal units of the polymer are preferably hydrogen or an aryl moiety (9:1-31). This corresponds to the instant formula where  $x$  is one and  $y$  is zero.

Considering Claim 2: Woo et al. teaches a homopolymer (13:65-46).

Considering Claims 3 and 4: Woo et al. teaches random or alternating copolymers (12:8-10).

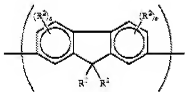
Considering Claim 5: Woo et al. teaches that the fluorenes can be unsubstituted/ $R^1$  and  $R^2$  are zero (2:48).

Considering Claim 6: Woo et al. teaches the  $R^2$  as being  $C_{1-10}$  alkoxy when present (4:41-62).

Considering Claims 11 and 12: As Woo et al. teaches the embodiment where  $y$  is zero, the nature of  $R_5$ - $R_8$  does not provide patentability to the polymer.

Claims 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Woo et al. (US 6,169,163).

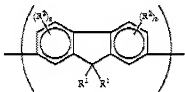
Considering Claim 8: Woo et al. teaches a polymer of the formula



(3:1-10) where  $R^1$  is preferably a poly(alkyleneoxy) group/linear aliphatic group containing hydrocarbons with a terminal group of  $-(CH_2)_bN(R^1)_2$  (4:27-33). Woo et al. teaches the polymer as having at least 10 repeat units (2:65-67). The terminal units of the polymer are preferably hydrogen or an aryl moiety (9:1-31). This corresponds the instant formula where  $y$  is zero.

Claim 66 is rejected under 35 U.S.C. 102(n) as being anticipated by Woo et al. (US 6,169,163).

Considering Claims 66: Woo et al. teaches a polymer of the formula



(3:1-10) where  $R^1$  is preferably a poly(alkyleneoxy) group/linear aliphatic group containing hydrocarbons with a terminal group of  $-(CH_2)_bN^+(R^1)_3$  (4:27-33). Woo et al. teaches the polymer as having at least 10 repeat units (2:65-67). The terminal units of the polymer are preferably hydrogen or an aryl moiety (9:1-31). This corresponds the instant formula where  $x$  is one  $y$  is zero.

### ***Claim Rejections - 35 USC § 103***

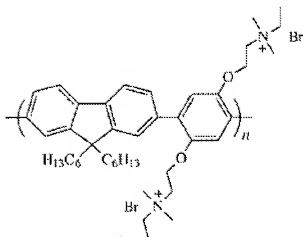
The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3-5, 7-21, 48-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994).

Considering Claims 1, 4, 5, 7, 13-15, 19, 49-52: Liu et al. teaches a polymer of the



formula Polymer II (page 551). This corresponds to the claimed polymer where  $x$  is zero. As the claims are directed towards a polymer comprising the claimed units, the claim does not exclude fluorene units that do not contain quaternized nitrogens.

Liu et al. does not teach the phenylene side chain as having both a heteroatom and an aromatic group. However, Rau et al. teaches using a phenoxy group in the side chain of a functionalized polyphenylene (page 4). Liu et al. and Rau et al. are combinable as they are concerned with the same field of endeavor, namely polyphenylenes with functionalized side chains. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the phenoxy groups of Rau et al. in the polymer of Liu et al., and the motivation to do so would have been, as Rau et al. suggests, to improve the solubility of the polymer (page 3).

Considering Claims 3, 20, and 21: Liu et al. does not teach the polymer as being random. However, due to the close structural similarity between the disclosed polymer and the claimed polymer a person having ordinary skill in the art at the time of invention



would have expected them to possess similar properties. Thus the claimed structure is prima facie obvious in view of the prior art structure. See MPEP § 2144.09.

Considering Claim 9 and 10: As Liu et al. teaches the embodiment where x is zero, the nature of R<sub>3</sub>-R<sub>4</sub> does not provide patentability to the polymer.

Considering Claim 16: Liu et al. teaches a weight average molecular weight of 47000 and a polydispersity of 1.61 (page 551). Based on a molecular weight of ~570 per repeat unit there would be approximately 51 repeat units per polymer. Since this is the average number of units, there would implicitly be polymers with less than this number of units/1 to 50.

Considering Claim 17: Liu et al. is silent as to an endcapping reaction. Therefore one could reasonably assume that the end units comprise one of each monomer type/an aryl moiety containing a halogen and a boron radical.

Considering Claim 18: Liu et al. does not teach endcapping. However, Huang et al. teaches endcapping a fluorene-phenylene polymer with aryl groups (¶0030). It would have been obvious to a person having ordinary skill in the art at the time of invention to have endcapped the polymer of Liu et al. with the aryl groups of Huang et al., and the motivation to do so would have been, as Huang et al. suggests, to end the reaction at the desired molecular weight (¶0030).

Considering Claim 48: Liu et al. does not teach the one of the R groups as being hydrogen. However, due to the close structural similarity between the disclosed polymer and the claimed polymer a person having ordinary skill in the art at the time of invention would have expected them to possess similar properties. Thus the claimed structure is prima facie obvious in view of the prior art structure. See MPEP § 2144.09.

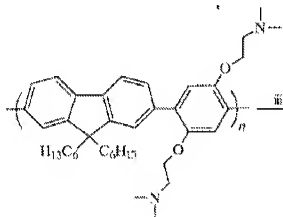
Considering Claim 53: Liu et al. teaches the highest degree of quaternization obtained as being 80% (page 552).

Liu et al. does not teach the quaternization degree as being from 30 to 60%. However, it is well known in the art to optimize result effective variables such as quaternization degree. It would have been obvious to a person having ordinary skill in the art at the time of invention to have optimized the degree of quaternization through routine optimization, and the motivation to do so would have been, as Liu et al.

suggests, to control the water solubility of the polymer (page 551). See MPEP § 2144.05.

Claims 32-39 and 65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994).

Considering Claim 32: Liu et al. teaches providing a polymer of the formula



(page 551); and quaternizing the terminal amino groups (page 551). : Liu et al. also teaches a weight average molecular weight of 47000 and a polydispersity of 1.61 (page 551). Based on a molecular weight of ~570 per repeat unit there would be approximately 51 repeat units per polymer. Additionally, Liu et al. is silent as to an endcapping reaction. Therefore one could reasonably assume that the end units comprise on of each monomer type/an aryl moiety containing a halogen and a boronate radical. As the claims are directed towards a polymer comprising the claimed units, the claim does not exclude fluorene units that do not contain quaternized nitrogens.

Liu et al. does not teach the phenylene side chain as having both a heteroatom and an aromatic group. However, Rau et al. teaches using a phenoxy group in the side chain of a functionalized polyphenylene (page 4). Liu et al. and Rau et al. are combinable as they are concerned with the same field of endeavor, namely polyphenylenes with functionalized side chains. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the phenoxy groups

of Rau et al. in the polymer of Liu et al., and the motivation to do so would have been, as Rau et al. suggests, to improve the solubility of the polymer (page 3).

Considering Claim 33: Liu et al. teaches the highest degree of quaternization obtained as being 80% (page 552).

Considering Claims 34-39: Liu et al. teaches stirring the polymer with bromoethane in DMSO and THF in a ratio of 1:4 at about 50 °C for 3 days/about 1 or 5 days (page 551).

Considering Claim 65: Liu et al. is concerned with the solubility of the polymer (page 551). Therefore a person having ordinary skill in the art at the time of invention would necessarily calculate the desired solubility and tailor the production to give this solubility.

Claims 40-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994) as applied to claim 36 above, and further in view of Ho et al. (WO 00/60612).

Considering Claims 40-42: Liu et al., Rau et al., and Huang et al. collectively teach the method of claim 36 as shown above. Additionally, during the conversion treatment of the polymer, at least a portion of the DMSO and THF would inherently evaporate.

Liu et al. does not teach the polymer as being precipitated and washed. However, Ho et al. teaches precipitating a fluorene polymer in acetone, centrifuging the precipitate and washing the polymer with chloroform (page 20). Liu et al. and Ho et al. are combinable as they are concerned with the same field of endeavor, namely fluorene copolymers. It would have been obvious to a person having ordinary skill in the art at the time of invention to have sued the purification steps of Ho et al. in the process of Liu et al., and the motivation to do so would have been, as Ho et al. suggests, to purify the polymer (page 20).

Liu et al. does not teach drying the polymer. However, Huang et al. teaches drying a fluorene polymer (§¶0030). It would have been obvious to a person having ordinary skill in the art at the time of invention to have dried the polymer of Liu et al. as in Huang et al., and the motivation to do so would have been, as Huang et al. suggests, to remove residual solvent from the polymer (§¶0030).

### ***Response to Arguments***

Applicant's arguments filed June 24, 2009 have been fully considered but they are not persuasive, because:

A) Applicants argument that Liu et al. and Rau et al. do not teach at least one of A and B as being NR'R"" is not persuasive. As x can be zero in the claimed structure, the claims do not require the presence of A or B. As such, in certain embodiments, the nature of A and B does not affect patentability. Additionally, as the claims are directed towards a polymer comprising the claimed units, the claim does not exclude flourene units that do not contain quaternized nitrogens.

### ***Correspondence***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Liam J. Heincer whose telephone number is 571-270-3297. The examiner can normally be reached on Monday thru Friday 7:30 to 5:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Eashoo can be reached on 571-272-1197. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mark Eashoo/  
Supervisory Patent Examiner, Art Unit 1796

LJH  
August 19, 2009